



Performance Metrics/Indicators

**Prepared for NASA/OPM
by BDM Federal, Inc.**

March 1996

Safety and Mission Assurance Training

PG-R1-6103-D01

Slide # 1

Student Notes

Training Module Objectives



- **Understand the Definition of Performance Metrics/Indicators**
- **Understand the Current NASA Contractor Metrics Program**
- **Acquire an Awareness of In-plant Metrics for Government Surveillance**

Student Notes

Outline



- **Overview**
 - Definition
 - Purpose
- **NASA Contractor Metrics**
- **Performance Indicators**
 - Key Contractor Surveillance Areas of Interest
 - Sources of Metrics
 - Government Use/Analysis
- **Examples of Performance Indicators**

Student Notes



Overview

- **Definition of Performance Metrics**
- **Purpose of Performance Metrics**

Student Notes

Definition of Performance Metrics



- **Metric:** “A standard of measurement” (Webster’s Collegiate Dictionary)
- **Contractor Metrics:** “The set of data which provides specific measures of contractor performance” (NHB 5340.4A)
- **Management Indicator:** “Workload or performance information used...to determine if further review and action are necessary...” (AFCMDR 178-13)
- **An Example: A Sales Chart**



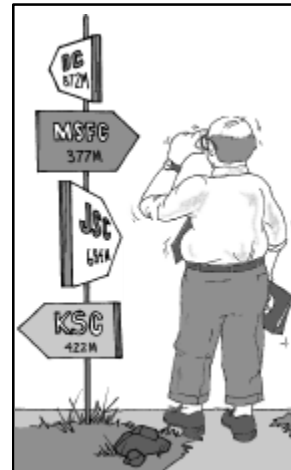
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Overview

Purpose of Performance Metrics



- **Provide a Baseline**
- **Provide Managers with Effective Indicators to Use in Evaluating Contractor Operations**
- **Provide Effective Indicators to Evaluate Systematic Techniques**
- **Predict Potential Trouble Areas and Take Timely Preventative Measures**
- **Permit Effective Utilization of Government Resources**



Student Notes

Summary of Overview



- **Performance Metrics and Indicators Are any Information Collected and Used to Track Contractor Performance**
- **NASA Uses this Information to Trigger Preventive and Corrective Actions in Trouble Areas and to Make Better Use of its Resources**

Student Notes



NASA Contractor Metrics Program

- **The NASA Contractor Metrics Program**
- **The Current Policy in Brief**
- **Status of Metrics Policy Revision**
- **An Example**

Student Notes

NASA Contractor Metrics Program



- **Objective: Provide NASA Managers Sufficient Information to Monitor Contractor Performance**
- **Policy Is Being Revised:**
 - Drafted by NHB 2340.4A, Contractor Metrics Handbook
 - New Draft to Be Determined

Student Notes

The Current Policy in Brief



- **A System of Metrics Reporting Will Be Used on Selected NASA Contracts**
 - NASA Contracts Will Be Selectively Chosen for Reporting Metrics
 - Existing Contractor Information Systems Will Be Employed
 - Performance Data Will Be Available through Contract Requirements
- **Products**
 - Set of Current Contractor Performance Data
 - Periodic Feedback Metric Report to Contractor
- **Metric Categories Identified**

Student Notes

NASA Contractor Metrics Program
Status of Metrics Policy Revision



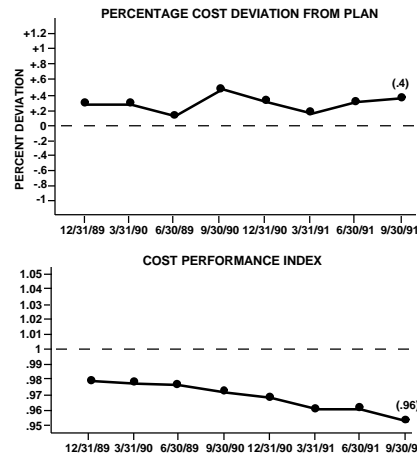
- **Revised Policy In-work**
- **Draft of NHB-2340.4A in Progress**
- **NHB 2340.4A Will Be Completely Revised**
- **New Thinking (?)**

Student Notes

NASA Contractor Metrics Program
Sample NASA Cost Metric Charts



• **NHB 2340.4A Example 1D**



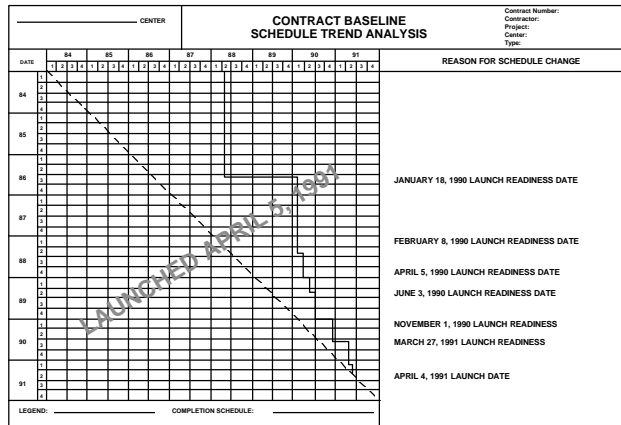
Contract Number:
 Contractor:
 Project:
 Center:

Student Notes

NASA Contractor Metrics Program **Sample NASA Schedule Metric Charts**



• **NHB 2340.4A Example 1F**



Student Notes

Contractor Metrics Summary



- **NASA Contractor Metrics Program Is Detailed in NHB 2340.4A**
 - It Provides Contractor Performance Information to NASA Managers
- **Contractor Metrics Reporting Enhances Communication without Overtaxing Contract and Government Resources**
 - Contractor Provides Current Data Used in Contract Fulfillment
 - NASA Reports Back Concerns and Perspectives Based on the Same Data
- **NHB 2340.4A Is Currently Being Revised**
 - Draft Due March 1996

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Performance Indicators

- **Key Contractor Surveillance Areas of Interest**
- **Sources of Metrics**
- **Government Use/Analysis**
- **Performance Indicator Examples**

Student Notes

Key Points to Consider



- **Program/Project**
 - **Contract Type and Requirements**
 - **Areas of Risk or Special Interest**
 - **Available Government Resources**
- **Contractor Environment**
 - **Contractor Past Performance**
 - **Existing Contractor Metrics/Tracking Systems**
 - **Contractor Project Management Structure**

Student Notes

Key Points to Consider (Concluded)



- **Metrics Management**
 - **Diligently Select Metrics to Track –Too Much Is Not Always Best**
 - **Validation of Indicator/Metric Data**
 - **Timeliness and Frequency of Samples**
 - **Look for “Big Picture” Metrics – Low-level Details May Be Just a Snapshot**
 - **Correlation of Indicators**
- **Others**

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Typical Key NASA Areas



- **Program Management**
- **Contract Management**
- **Quality Assurance**
- **Engineering**
- **Manufacturing Operations**

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Typical Key NASA Areas
Program Management



- **Key Area for Overall Contractor Program Activities**
 - **Management Planning, Scheduling, and Integration**
 - **Functional Coordination**
 - **Central Communications**
 - **Program Control**
 - **Project Resource Planning and Execution**

Student Notes

Program Management (Concluded)



- **Elements Program Indicators Should Demonstrate**

- Progress against Defined Baseline
- Posture of Cost, Schedule, and Technical Requirements of Program
- Key Program Milestones and Events
- Risk Areas and Critical Path
- Current Problem Areas
- Corrective and Preventive Action Plans and Status
- Customer Feedback

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Typical Key NASA Areas
Contract Management



- **Key Area for Contract Activities**
 - **Focal Point for Contract Matters**
 - **Point of Contact for Government Contracting Officer**
 - **Management of Estimating/Pricing Functions**
 - **Management of Government Furnished Property/Equipment/Facilities**

Student Notes

Typical Key NASA Areas

Contract Management (Concluded)



- **Elements Contract Indicators Should Demonstrate**
 - **Contract Administrative Status**
 - **Responsiveness and Timeliness to Government Contract Matters**
 - **Contract Financial Status**
 - **Business Strength**
 - **Project Priority within Company**

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Typical Key NASA Areas
Quality Assurance



- **Key Area for Quality Assurance Activities**
 - **Focal Point for Quality System**
 - **Responsible for Quality Planning**
 - **Point of Contact for Mandatory Government Inspections (MGIs)**
 - **Management of Non-conforming Material**
 - **Focus for Hardware/Software Quality (“As Designed” Versus “As Built”)**

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Quality Assurance (Concluded)



- **Elements Quality Indicators Should Demonstrate**
 - **Project Quality Status**
 - Number of Defects
 - Scrap, Rework, and Repair
 - **Inspection Results and Quality Escapes**
 - **Component Defect Rates**
 - **Corrective and Preventive Action Planning and Close-out**
 - **Supplier Quality**

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Engineering



- **Key Area for Engineering Activities**
 - **Focal Point for Engineering System**
 - **Responsible for Design**
 - **Focus for Configuration Management**
 - **Responsible for Technical Analyses**
 - **Focal Point for Research and Development**
 - **Focal Point for Project Design Events**
 - **Responsible for Technical Requirements Flowdown**
 - **Responsible for Failure Analysis as well as Corrective and Preventive Action**

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Typical Key NASA Areas
Engineering (Continued)



- **Elements Engineering Indicators Should Demonstrate**
 - **Design Status and Maturity**
 - **Drawing/Specification Status**
 - **Test Results**
 - **Design Review Readiness and Status**
 - **Progress of Internal Design Milestones**
 - **Traceability**
 - **Test Anomaly Close-out Status**

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Engineering (Concluded)



- **Elements Engineering Indicators Should Demonstrate (Concluded)**
 - **Configuration Status**
 - **Timeliness of Drawing Releases**
 - **Number of Drawing Changes and Errors**
 - **Timeliness of Failures Analysis Close-out**

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Manufacturing Operations



- **Key Area for Manufacturing Activities**
 - **Focal Point for Manufacturing System**
 - **Responsible for Production and Delivery of Hardware/ Test End Items**
 - **Focus for Productivity Issues**
 - **Focal Point for Advanced Manufacturing Concepts and Capability**

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Manufacturing Operations (Concluded)



- **Elements Manufacturing Indicators Should Demonstrate**
 - **Production Status**
 - Hardware Delivery versus Contract Schedule
 - Tooling and Fixture Readiness and Status
 - **Efficiency of Manufacturing Labor/Overhead**
 - Performance Index
 - Labor Variations versus Standards
 - **Project Component Yield Rates/Capability**

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Summary of Typical Key NASA Areas



- **Project Management**
 - Implements Functional Coordination and Resource Planning
 - Metrics Indicate Critical Path, Risk Milestones, and Progress
- **Contract Management**
 - Responsible for Contract Matters, Estimating/Pricing, GFE Management
 - Metrics Indicate Contract Administrative and Financial Status, Response to Government Contract Matters, Business Strength, Project Priority
- **Quality Assurance**
 - Responsible for Quality Systems and Planning, Mandatory Inspections, Non-conforming Materials
 - Metrics Indicate Project and Supplier Quality Status, Corrective Action Planning and Status, Inspection Results, Defect Rates
- **Engineering**
 - Focal Point for Engineering Systems, Configuration Management, Research and Development
 - Metrics Should Indicate Design Status and Maturity, Configuration Status, Failure Analysis, Close-out Timeliness
- **Manufacturing**
 - Provides Focus for Productivity Issues, Advanced Manufacturing, Production, and Delivery of Hardware

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Performance Indicators
Sources of Metrics



- **Contractor**
- **Contract Required**
- **Operations**
- **Individually Created**

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- **Most Ready Source of Metrics**
 - Immediately Available
 - Contractor's Real-time Results
 - Comprehensive Raw Data
 - It's What the Contractor Uses
- **Possible In-plant Sources**
 - Project Generated Data
 - Management System Data
 - Internal Management Data

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Contract Required



- **Formal Government Source of Metrics**
 - Always Available to the Government (It's Government Data)
 - Results are Usually for a Period (Often a Top-level Perspective and Analysis)
 - It's What the Contractor Commits to
- **Possible In-plant Sources**
 - Contract Line Item Distribution (or PO)
 - Courtesy Copy from Contractor

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- **The Final Test**
 - **Project Product in Mission Environment**
 - **Project Results by Government Use**
 - **System-level Performance Data**
- **Possible Sources**
 - **Operation/Mission Reports**
 - **Contractor Post-mission Analysis (or PO)**
 - **Contractor Courtesy Copy of Mission Report**

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Individually Created



- **Tailored Perspective**
 - **Meet Specific Need (Trend or One Time)**
 - **Independent View Point**
 - **Complete Missing Information**
- **Possible In-plant Sources**
 - **You Create the Metric**
 - **NASA Resident Office Information**
 - **DCMC Information**

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- **Contractor Performance Surveillance**
- **Contractor Past Performance**
- **Tips on Use and Analysis**

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Contractor Performance Surveillance



- **Support Verification of Contract Requirements**
- **Trend Cost, Schedule, and Technical Performance**
- **Facilitate Identification of Potential Project Problems**
- **Support Validation of Corrective Action**
- **Permit Integration of Project Overall Posture**
- **Provides Government Contract Supporting Data**

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Contractor Past Performance



- **Establishes History of Performance**
- **Permits Competitive Comparison (Contract Data)**
- **Provides Valuable Source of Information on Future Project Situations**
- **Provides Source of Lessons Learned**

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Tips on Use and Analysis



- **Establish a Set of Metrics:**
 - **Determine Needed Metrics:**
 - Keep to Manageable Size
 - Select “Big Picture” Indicators
 - Select Wide Range - Cover All Areas
 - **Establish Distribution Sources**
 - **Set-up Simple, but Consistent Bookkeeping**

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Tips on Use and Analysis (Continued)



- **Validate Metrics**
 - **It's Best to Baseline**
 - **Periodically, Probe Metric for Accuracy**
 - **Correlate Several Metrics for Consistency**
 - **Conduct Independent Assessments**

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Tips on Use and Analysis (Concluded)



- **Review Metrics Data with Project Office and Contractor**
 - Establish a Review Mechanism
 - Request Contractor Rationale for Glitches or Adverse Trends
 - Establish and Review Corrective Action
- **Take Action**
 - Understand Available Remedies
 - Initiate Request for Corrective Action
 - Execute Remedy

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Summary of Government Use/Analysis



- **Support Contract Performance Surveillance such as:**
 - Verification of Contract Requirements
 - Identification of Potential Problems
 - Support of Corrective Action
- **Contractor Past Performance**
 - Establish Performance History and Project Projection Basis
- **Establish a Set of Metrics**
 - Simple, Consistent Bookkeeping
 - Limited Set of Indicators
 - Validated Metrics
- **Review Metrics Data with Project Office and Contractor**
- **Take Action**

Student Notes



Examples of Performance Indicators

- **Project Management**
- **Contract Management**
- **Quality Assurance**
- **Engineering**
- **Manufacturing Operations**

Student Notes

Project Management Examples



- **Program Metrics**
 - Sample 1
 - Sample 2
- **Mission Data**

Student Notes

Program Metrics Sample 1



ASSESSMENT OF CONTRACTOR OPERATIONS MANUFACTURING DIVISION

FUNCTION	1991				1992							
	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
PRODUCT INTEGRITY					↓	↓						
QUALITY ASSURANCE						↑	↓					
PROGRAM MANAGEMENT							↓	↓				
SYSTEM ENGINEERING												
MANUFACTURING												↓
CONTRACT MANAGEMENT				↓	↓	↓						

↑ GETTING BETTER ↓ GETTING WORSE □ SATISFACTORY □ MARGINAL ■ UNSATISFACTORY

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Project Management Examples

Program Metrics Sample 2



■ STRONG
 ■ MEDIUM
 ■ WEAK
 □ NONE

		LAUNCH ISSUES		ENGINE SYSTEM PERFORMANCE		ENGINE SYSTEM EFFICIENCY		ENGINE SYSTEM RELIABILITY	CANNIBALIZATION	QUALITY						SAFETY		
		TECHNICAL ISSUES TO LEVEL 1	LAUNCH DELAYS	IN FLIGHT ANOMALY (IFA)	COMPONENT REPLACED AFTER ENGINE INSTALL	TEST AND UNPLAN; ENGINE SHOP REPLACED	COMPONENTS REJECTED; INSPECT, REPAIR, AND REPLACE	COMPONENT RELOCATIONS CANNIBALIZATION	RELIABILITY	COST OF SCRAP (4 CHARTS)	MANUFACTURING UCR ESCAPES	DAR/LRU (6 CHARTS)	ACCEPTANCE TEST (GENERAL FIRST PASS SUCCESS) (2 CHARTS)	NG/MR/1000 HRS AND UCR TREND (17 CHARTS)	REWORK/REPAIR COST PER 1000 HRS AND PER UNIT (7 CHARTS)	SCRAP COST (2 CHARTS)	HARDWARE HIGH-SPIN/MONTH	OSHA REPORTABLES
SECTION (PAGE)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	PERFORMANCE																	
B	SAFETY																	
C	DEPENDABILITY																	
D	DURABILITY																	
E	QUALITY																	
F	SCHEDULE																	
G	COST																	
H	PREDICTOR					3		3	2, 3	26	3	1	3	1, 3, 26	26	26	26	26
REPORT FREQUENCY		PER FLIGHT	PER FLIGHT	PER FLIGHT	PER FLIGHT	PER ENGINE MONTH	PER FLIGHT	PER FLIGHT	PER FLIGHT	MONTHLY	MONTHLY	MONTHLY	MONTHLY	MONTHLY	MONTHLY	MONTHLY	MONTHLY	MONTHLY

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Safety and Mission Assurance Training

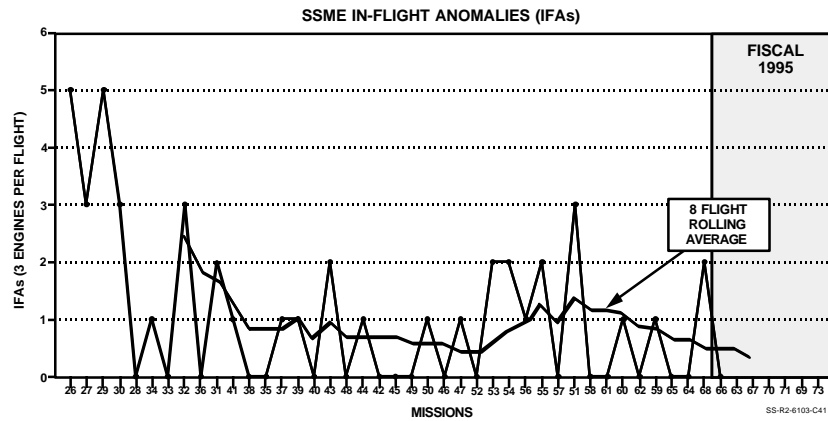
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Project Management Examples

Mission Data Sample



Student Notes

Contract Management Examples



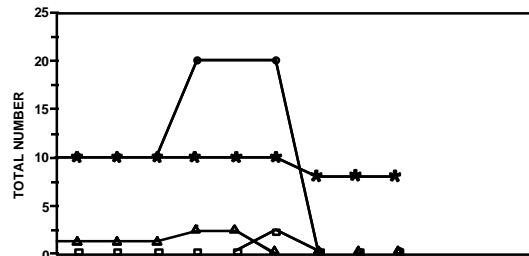
- **Overage Contract Status**
- **Purchase Order Activity**

Student Notes

Contract Management Examples Overage Contract Status Sample



CONTRACTS
COMPLETED/OVERAGE



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FY95 - REOS MANAGED NASA CONTRACTS ★	10	10	10	10	10	10	8	8	8			
NUMBER OF CONTRACTS ▲	1	1	1	2	2	0	0	0	0			
PERCENT OF OVERAGE ○	10	10	10	20	20	20	0	0	0			
CONTRACTS CLOSED □	0	0	0	0	0	2	0	0	0			

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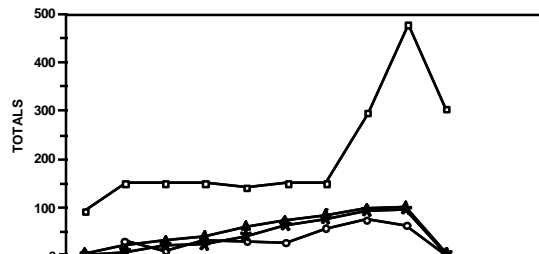
Student Notes

Contract Management Examples

Purchase Order Activity Sample



PURCHASE ORDER ACTIVITY
P.O. + CHANGE ORDERS/ DELIVERY ISSUED - ACKNOWLEDGED



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
P.O. + CHANGE ORDERS	81	145	143	143	133	147	144	288	476	308		
DELEGATION ISSUED CUMULATIVE	2	26	50	74	79	85	93	102	115	10		
DELEGATION ACKNOWLEDGMENT CUMULATIVE	4	7	29	42	60	73	80	95	103	14		
NEW AGLS		42	20	62	37	29	56	73	60	13		

AVERAGE DAYS TO DEVELOP AGLS IS DROPPED
P.O. AND CHANGE ORDERS ARE COMBINED FOR CLARITY AND EXPECTED TO LEVEL OFF AT 140
DELEGATION ACKNOWLEDGMENT IS FOLLOWED UP BY PHONE CALLS

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Student Notes

Quality Assurance Examples



- **Nonconformance Costs**
 - **Scrap, Rework, and Repair Trend**
 - **Material Review Board Actions Trend**
- **Mandatory Government Inspection Activity**

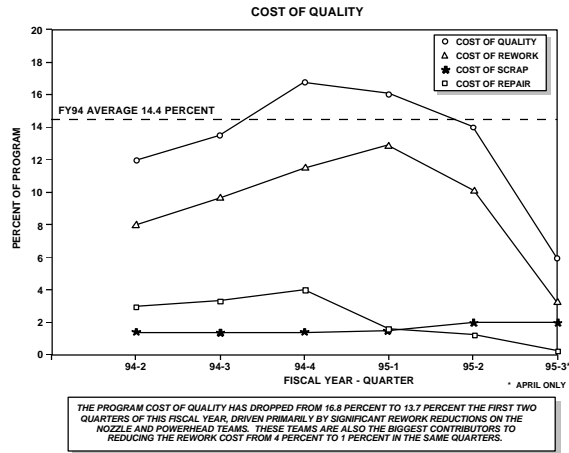
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Quality Assurance Examples

Nonconformance Costs



Scrap, Rework, and Repair Trend Sample



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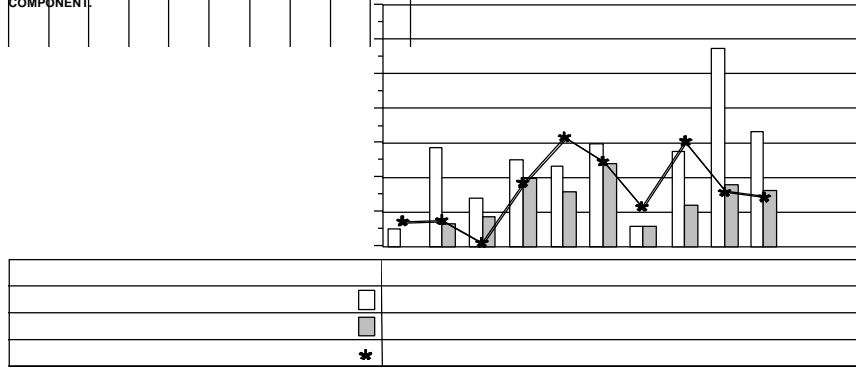
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Nonconformance Costs



Material Review Board Actions Trend Sample

CONTROL SYSTEM AND SOFTWARE AND SUPPORT EQUIPMENT. 2 EACH FC COMPONENT.



Student Notes



MANDATORY GOVERNMENT INSPECTION

	1994		1995						
	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
AVERAGE RESPONSE TIME	15	9.5	10	5.5	6.9	5.4	30	8.8	9.8
NUMBER OF CALLS	50	50	48	91	187	129	205	193	176
TOTAL TIME IN MONTH			480	500.5	1290	696	6150	1698	1725

NOTE: ANALYSIS OF GOVERNMENT MANDATORY INSPECTION POINTS (GMIPS) IN ACCORDANCE WITH LETTER OF DELEGATION (LOD) IS BEING PERFORMED. CHART WILL FOLLOW IN NEAR FUTURE.

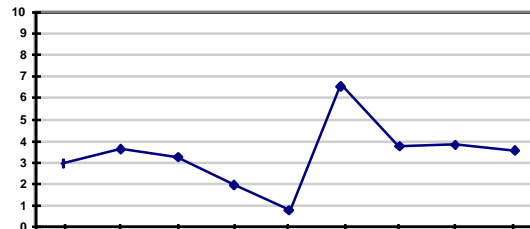
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Quality Assurance Examples
Mandatory Government Inspection Activity Sample



(MGI) Buy-off Response Time



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
NUMBER OF CALLS	871	1298	974	1157	1054	766	894	687	655
AVERAGE RESPONSE TIME	2.94	3.58	3.24	1.94	0.75	6.5	3.7	3.78	3.53
NOT READY	12	22	29	27	23	21	29	22	24

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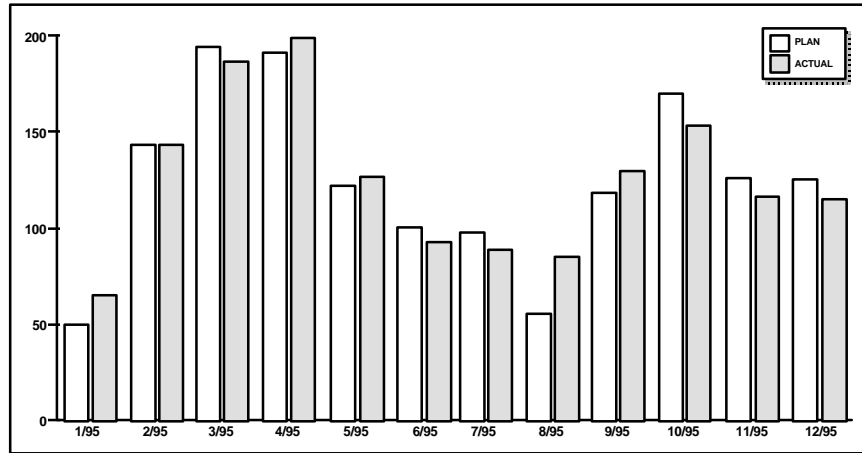
- **Design Activity**
 - Drawing Releases versus Plan
- **Configuration Management Activity**
 - Number of Class I ECPs per Month
 - Number of Major Waivers/Deviations per Month

Student Notes

Engineering Examples
Design Activity



Drawing Releases versus Plan Sample

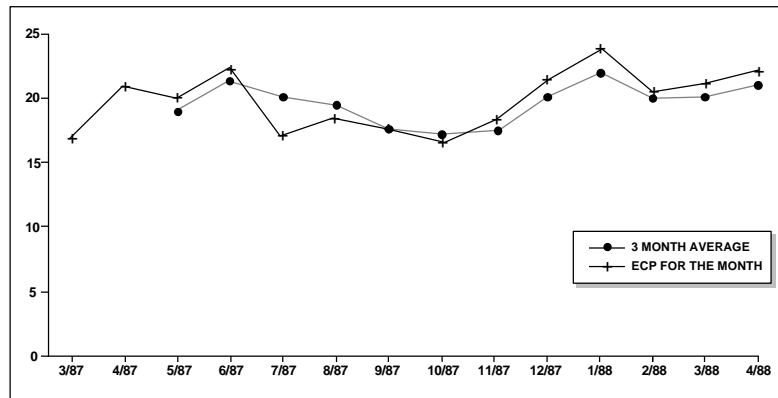


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Number of Class I ECPs per Month Sample

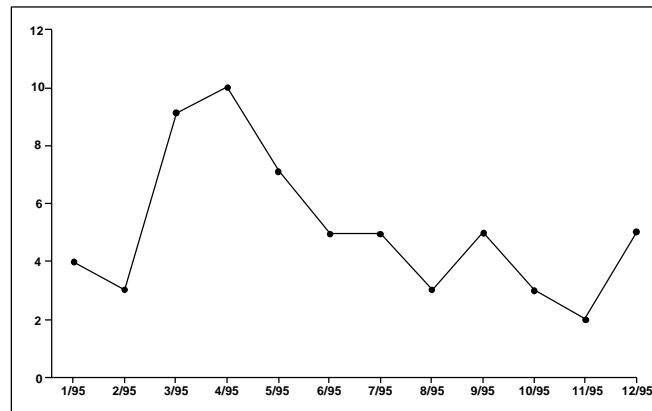


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Student Notes



Number of Major Waivers/Deviations per Month Sample



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Manufacturing Operations Examples

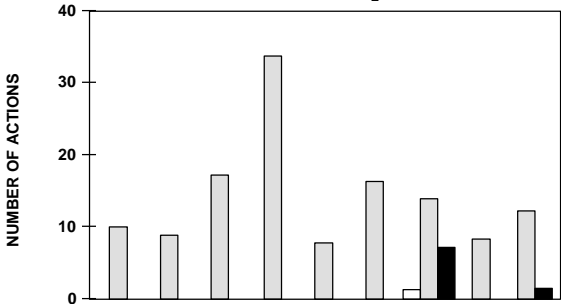


- **Manufacturing Activity**
 - **Corrective Action Status Sample**
- **Productivity**
 - **Selected Process Yields/Capability Sample**

Student Notes



Corrective Action Status Sample



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
NUMBER OF CIOs	0	0	0	0	0	0	1	0	0
NUMBER OF LEVEL I (CAR)	10	9	17	34	8	16	13	7	12
NUMBER OF LEVEL II (IDCR)	0	0	0	0	0	0	6	0	1

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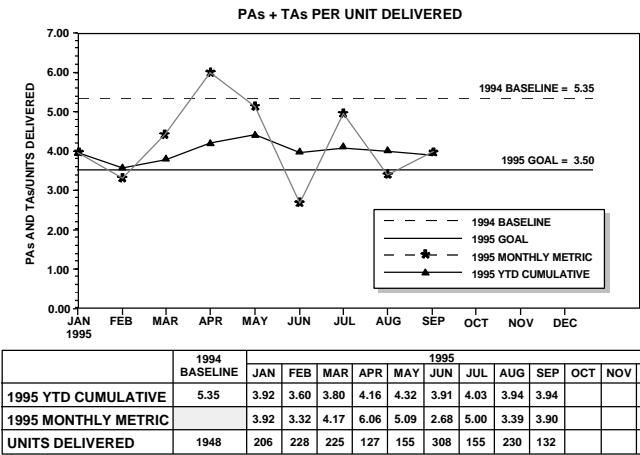
Student Notes

Manufacturing Operations Examples

Productivity



Selected Process Yields/Capability Sample



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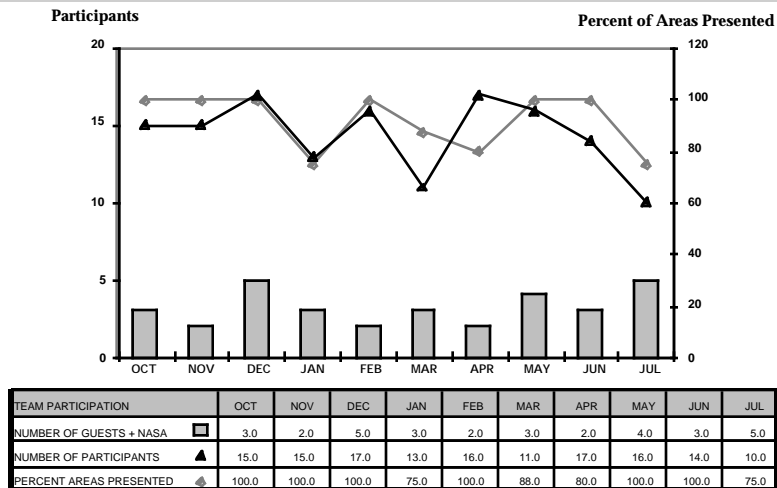
Wrap-up



- **What Have We Covered?**
 - **The Definition**
 - **NASA Contractor Metrics Program Status**
 - **Key Areas of Interest for Contractor Surveillance**
 - **Sources of Surveillance Metrics**
 - **Government Tips/Usage**
 - **Samples**
- **Questions?**
- **Now Let's Check How Well We Learned**

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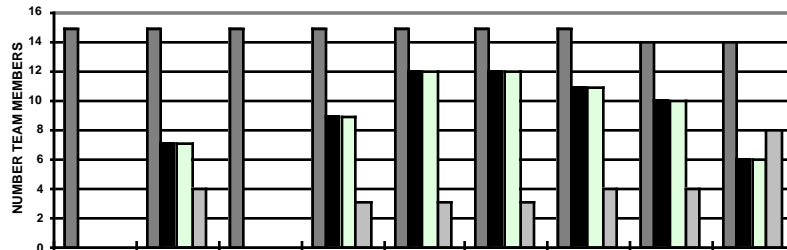
Monthly PST Team Meeting FY95 Team Participation



RB-R1-6103-H04

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SSME Program Support Team Meeting Activity



	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
TOTAL	15	15	15	15	15	15	15	14	14
PRESENT		7	0	9	12	12	11	10	6
ACTIVE		7	0	9	12	12	11	10	6
EXCUSED		4	0	3	3	3	4	4	8

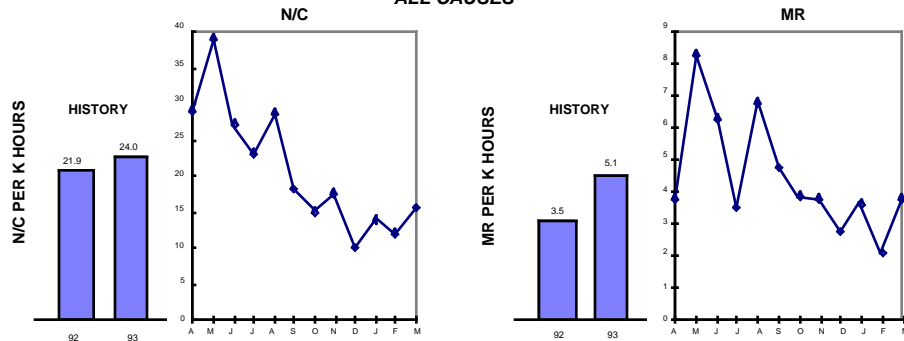
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Nonconformances Per 1000 D/L Hours



ALL CAUSES



	1994						1995					
	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
N/C	1258	1204	1051	832	1489	724	545	751	274	433	367	618
MR	158	247	244	128	355	183	139	157	75	107	67	143
K HOURS	42.6	30.3	39.5	37.3	51.7	38.6	36.9	41.4	27.4	31	32.5	39.9

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Slide #

Nonconformances Per 1000 D/L Hours All Causes

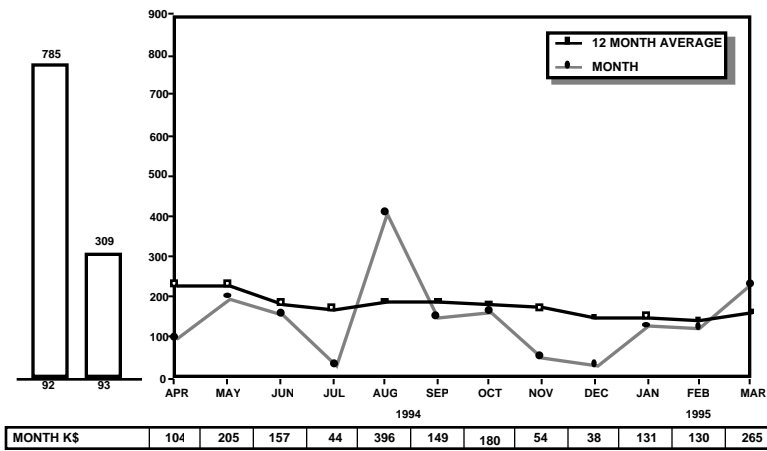


Purpose:	Predictor of hardware schedule and cost impacts
Definition:	Nonconformances do not meet the drawing requirements. MRs are any nonconformance that cannot be returned to the drawing requirements but can be repaired and satisfy intended function. Touch labor hours are fabrication on-site hands-on effort
Derivation:	Nonconformance count comes from the quality data system and is divided by the touch labor hours for that month. MRs come from PRAMS and are divided by the same base. All N/Cs and MRs, regardless of cause, are included.
Frequency:	This will be plotted on a monthly basis and displayed as a previous 12-month run chart. Fiscal year summaries will be displayed in bar format.

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Scrap Trend

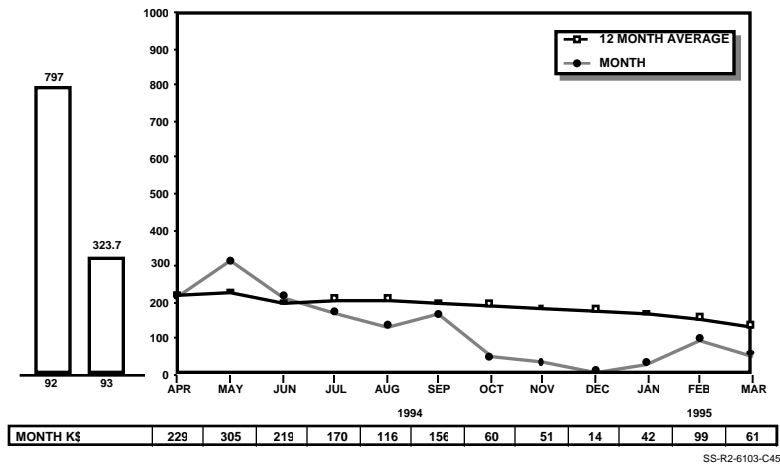


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Slide #

Usage Scrap Cost



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